# Photonic matrix multiplication lights up photonic accelerator and beyond

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## Abstract

Matrix computation, as a fundamental building block of information processing in science and technology, contributes most of the computational overheads in modern signal processing and artificial intelligence algorithms. Photonic accelerators are designed to accelerate specific categories of computing in the optical domain, especially matrix multiplication, to address the growing demand for computing resources and capacity. Photonic matrix multiplication has much potential to expand the domain of telecommunication, and artificial intelligence benefiting from its superior performance. Recent research in photonic matrix multiplication has flourished and may provide opportunities to develop applications that are unachievable at present by conventional electronic processors. In this review, we first introduce the methods of photonic matrix multiplication, mainly including the plane light conversion method, Mach–Zehnder interferometer method and wavelength division multiplexing method. We also summarize the developmental milestones of photonic matrix multiplication and the related applications. Then, we review their detailed advances in applications to optical signal processing and artificial neural networks in recent years. Finally, we comment on the challenges and perspectives of photonic matrix multiplication and photonic acceleration. This review summarizes the advances of photonic accelerators from the viewpoint of photonic matrix multiplication, providing a guidance for all-optical or optoelectronic-hybrid AI hardware chip system.